REMARKS

Claims 11-12, 15, 21, 31and 33-35 have been amended. Claims 19 and 32 have been canceled without prejudice to resubmission. Claims 1-18 and 20-31 and 33-35 are currently pending in the present application.

The applicant would like to thank the Examiner for providing a detailed analysis of all of the rejections in the Office Action.

The drawings have been objected to under 37 C.F.R. §1.83(a) on the basis that the structure for attaching the catheter attachment to the catheter of claims 21-30 must be shown in the drawings. This objection is respectfully traversed on the basis that the snap fit 14 of Fig. 1 is a structure for attaching the catheter attachment to a catheter and thus this feature of claims 21-30 is shown in Fig. 1. Favorable consideration and withdrawal of this objection to the drawings is requested.

The drawings have also been objected to on the basis that reference elements 17 and 39 are not shown in the drawings. Applicant has proposed minor modifications to Figs. 1 and 4 to insert the reference numerals 17 and 39 in the drawings. Basis for the modifications are the descriptions of numerals 17 and 39, with reference to Figs. 1 and 4, respectively, in the application as originally filed.

The drawings have also been objected to on the basis that radioactive material 61 is not shown clearly in Figure 7. In order to correct this, applicant has proposed a minor modification to Fig. 7 to delete an incorrect reference to element 62, and has renumbered Fig. 7 as Fig 7A. Applicant has also proposed three new figures 7B-7D to more clearly show the radioactive material 61. Basis for the three new figures 7B-7D can be found at page 10, lines 14-22 of the original specification. No new matter has been added. Minor amendments have also been proposed for pages 4 and 10-11 of the specification to refer to the proposed new figures. It is considered that proposed new Figures 7B-7D clearly show the radioactive material 61 in the various embodiments of microspheres 62 that are disclosed on page 10 of the original specification. Favorable consideration and approval of the proposed new figures 7B-7D and the proposed drawing changes are requested.

The disclosure has been objected to on the basis that there is a minor typographical error on page 8, line 22 of the specification. The specification has been amended to correct this minor error.

The disclosure has also been objected to on the basis that, in the opinion of the Examiner, page 12, lines 14-18 appeared to be inconsistent with the operation of the device described in the following paragraph on the same page of the specification. This objection is respectfully traversed and reconsideration is requested.

More particularly, page 12, lines 14-18 read as follows, "Once the radioactive material is in the desired position in the treatment zone and relative to the boundaries of the treatment zone, the expansion is ceased and the radioactive material is permitted to dwell in the treatment zone until the prescribed dose has been delivered." In the applicant's view, this statement is entirely consistent with the operation of the device described in the following paragraph on the same page. Specifically, the device is described as being expandable to position the radioactive material by, for example, providing saline solution, gel or foam to chambers 92 via fluid pathway 94. It is explained at page 13, lines 14-18 that expansion of the device in this manner immobilizes the radiation source in the treatment zone for the duration of the treatment, just as was described above at page 12, lines 14-18.

Thus, in the applicant's view, the text at page 12, lines 14-18 is entirely consistent with the mode of operation of the device described in the following paragraph on the same page. Favorable consideration and withdrawal of the objection are requested.

The Examiner's renumbering of claims 31-36 as claims 30-35 is acknowledged. Claim 32 has been canceled without prejudice to resubmission. Claims 33-35 have been amended to correct their dependencies based on the renumbering of claim 32 as new claim 31, in accordance with the Examiner's suggestion.

Claims 11-12, 19 and 32 have been rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Specifically, claims 11 and 19 were rejected on the basis that there is insufficient antecedent basis for the limitation, "...to which the radioactive source is bonded." Claim 19 has been canceled thereby obviating the rejection of claim 19. Claim 11 has been amended to overcome this objection by replacing the objected to phrase with, "...in which the radioactive source is housed." Basis for this amendment is found in claim 7 from which claim 11depends. Favorable consideration and withdrawal of the rejection of claim 11 is requested.

Claim 12 has been rejected on the basis that it omits essential structural cooperative relationships of elements, i.e. a catheter body and carrier. Although the applicant does not agree with this objection, the applicant has adopted the Examiner's proposed language for claim 12

thereby obviating the rejection. Favorable consideration and withdrawal of the rejection are requested.

Claim 32 has been rejected on the basis that the claim limitation "the structure" lacks antecedent basis. Claim 32 has been canceled without prejudice to resubmission thereby obviating this rejection. Favorable consideration and withdrawal of the rejection are requested.

Claim 1 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Dake et al. (U.S. Patent No. 5,199,939) in view of Alt (U.S. Patent No. 5,871,437). This rejection is respectfully traversed and reconsideration is requested for the reasons, which follow.

The present invention, as claimed in claim 1, relates to a catheter useful for irradiation of a body including an elongate flexible catheter body and a radioactive source bonded to a surface of the distal section of the catheter body. The radioactive source is bonded to a surface of the distal section of the catheter body with sufficient bond strength that under normal conditions of use, the radioactive source will not detach from the catheter body. This provides the advantage that no special measures must be taken to safeguard the patient from an accidental discharge of radioactive material into the body. In addition, the bonding strength of the radioactive material is such that it allows placement of the radioactive material in the most favorable treatment location, i.e. bonded to the inner or outer surface of the catheter. This can be done without having to put additional coatings on the radioactive material to keep it in place. This is highly advantageous because the preferred forms of radioactive emitters for this application are beta-emitters, which are characterized by the fact that the radiation dose drops off sharply even a short distance from the emitter. As a result, it is very important to place the radiation emitter as close as possible to the treatment area to achieve the maximum effect of the radiation, to minimize unwanted irradiation of other organs, and to ensure a relatively even dose distribution throughout the treatment area in order to avoid hot spots that might lead to over radiation.

Thus, the applicant's provision of the ability to bond a radioactive source strongly to the catheter permits simplification of the device, better placement of the radioactive material relative to the treatment area, more effective use of the radiation emitted by the radioactive material, a minimization of the risk to the patient due to unwanted radiation dose, and a simplification of the manufacture of the catheter, since no additional coatings or special chemicals are required. These numerous advantages of the apparatus of claim 1 render it clearly unobvious over the cited prior art.

Turning to the art, the Examiner relies on Dake et al. as disclosing a catheter for endoluminal radiation treatment having an elongate, flexible hollow body 12 with a radioactive source 14 located in the radioactive segment of the distal section 20 of the catheter. Dake et al. employs the radioactive material in the form of pellets 14 of radioactive material included in a carrier 12. See col. 5, lines 18-24 of Dake et al. Dake et al. also teaches that the pellets should be spaced, preferably about 1 mm apart, to maintain the flexibility of the flexible body 12. See col. 5, lines 24-27 of Dake et al.

The Examiner then takes the position that it would be obvious to modify the device of Dake et al. to provide a coating on the surface of the catheter in view of the teachings of Alt, wherein the radioactive source is bonded to the distal section of the catheter with sufficient bond strength for proper adherence as taught by Alt. The applicant disagrees with this conclusion since bonding the radioactive source to the catheter with sufficient bond strength to meet the claims of the present application contradicts the teachings of Alt.

More specifically, it is clear from a reading of the whole contents of Alt that Alt desired to incorporate radioactive material onto a stent in a manner whereby it is released into the body so that the radioactive material dissipates over time. For example, claim 4 of Alt states,

> "...irradiating the tissue in the wall at said site with a radioactive substance in a biodegradable carrier which is not metabolized or absorbed by the body adhered to the surface of the stent so that the radioactive substance substantially dissipates in a time interval determined by the thickness of the biodegradable carrier on the stent."

This claim 4 of Alt exemplifies the teaching of Alt which is to ensure that the radioactive material does not remain bonded to the stent but rather that the radioactive material is released into the body so that it can be excreted to thereby dissipate the radioactive material. This is necessary for Alt since the stent will remain in the patient's body and thus there is no other way to dissipate the radioactive material. This is in direct contrast to the present invention wherein it is desirable to retain the radioactive material bonded to the catheter since the catheter, including the radioactive material, will be removed from the body when treatment is completed.

Alt ensures dissipation of the radioactive material from the body by, for example, chemically binding the radioactive material to a substance that is readily excreted from the body (i.e. inulin) to prevent incorporation of the radioactive material into parts of the body. See e.g.

col. 6, lines 34-39 and col. 8, lines 30-36. Thus, it is clear from a reading of the entire Alt document that a person skilled in the art following the teachings of Alt would be led to coat the radioactive material onto a surface of a stent using a biodegradable coating to allow dissipation of the radioactive material over time into the body and would bind the radioactive material to a material that is readily excreted from the body, i.e. inulin. Accordingly, a skilled person following the teachings of Alt would not arrive at the present invention wherein it is desirable to maintain the radioactive material bonded to the catheter at all times.

Claims 2-6 all depend from claim 1 and are thus considered be patentable over the combination of Dake et al. and Alt for the same reasons as are given for claim 1 above. Neither U.S. patent No. 5,302,168 (Hess), U.S. Patent No. 6,217,503 (Weinberger et al.), nor U.S. Patent no. 5,405,309 (Carden, Jr.) cures the deficiencies of the primary references to Dake et al. and Alt and thus claims 2-6 are considered to be patentable over the cited prior art for the same reasons as claim 1. Favorable consideration and withdrawal of the rejections of claims 1-6 under 35 U.S.C. §103(a) is respectfully requested.

Claims 7-8, 12-13 and 15-16 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Dake et al. in view of U.S. Patent No. 5,282,781 (Liprie). This rejection is respectfully traversed and reconsideration is requested for the reasons, which follow.

The present invention, as claimed in claim 7, relates to a catheter useful for radiation treatment of a body including an elongate, flexible catheter body and a radioactive source housed within a cavity in the distal section of the catheter body. A portion of the catheter body is removable to provide access to the cavity wherein the radioactive source is housed. In this manner, a simple, easy to use catheter is provided that can locate the radioactive source very close to the treatment area. This is highly advantageous because the preferred forms of radioactive emitters for this application are beta-emitters, which are characterized by the fact that the radiation dose drops off sharply even a short distance from the emitter. As a result, it is very important to place the radiation emitter as close as possible to the treatment area to achieve the maximum effect of the radiation, to minimize unwanted irradiation of other organs, and to ensure a relatively even dose distribution throughout the treatment area in order to avoid hot spots that might lead to over radiation.

The Examiner takes the position that Dake et al. discloses provision of a plurality of cylindrical pellets 14 of radioactive material in the distal end of a catheter body 12. However,

the Examiner admits that Dake et al. does not disclose that a portion of the catheter body is removable to provide access to the cavity wherein the radioactive source is housed. Instead, the Examiner relies on Liprie as teaching a wire assembly 10 having a hollow tube 12, which the Examiner equates to a catheter, and wherein a radioactive source is housed in a cavity in the distal end of the wire assembly 10 and a plug 27 is utilized for placement and containment of the source in the cavity.

The applicant disagrees with the Examiner's position on the basis that the Examiner's assumption that the "hollow tube 12" of Liprie is a "catheter" is incorrect, since a skilled person, reading Liprie, would immediately know that the "hollow tube 12" is part of the wire assembly and is not a catheter as the Examiner suggests. For example, at col. 8, line 67 to col. 9, line 1, Liprie teaches that, "Among the components of the source wire 10 is a thin, continuous, elongate, flexible metal tube 12..." This is the hollow tube 12 referred to by the Examiner and thus Liprie makes it absolutely clear that the hollow tube 12 is part of the source wire 10. This is important in view of the disclosure in relation to Fig. 7 of Liprie since Fig. 7 of Liprie depicts the source wire 10 being advanced through an implanted catheter 75. See col. 18, lines 50-52 of Liprie. Thus, it is absolutely clear that the hollow tube 12, relied on by the Examiner, is not part of catheter but rather is part of the source wire 10 of Liprie.

This means that a skilled person following the teachings of Liprie would not arrive at the present invention as claimed in claim 7 of the present application since the skilled person would be taught to fabricate a separate source wire 10 for insertion through a catheter 75, such as the catheter of Dake et al., and not to provide a cavity in the distal end of the catheter for housing the radiaoactive material and provide a means for accessing the cavity as claimed in claim 7 of the present application. Accordingly, favorable consideration and withdrawal of the rejection of claim 7 under 35 U.S.C. §103(a) over the combination of Dake et al. and Liprie is requested.

Claims 8-14 all depend from claim 7 and are thus considered be patentable over the combination of Dake et al. and Liprie for the same reasons as are given for claim 7 above. Neither U.S. patent No. 5,302,168 (Hess), U.S. Patent No. 6,353,682 (Leavitt et al.), nor U.S. Patent no. 5,405,309 (Carden, Jr.) cures the deficiencies of the primary references Dake et al. and Liprie and thus claims 9-14 are considered to be patentable over the cited prior art for the same reasons as claim 7. Favorable consideration and withdrawal of the rejections of claims 7-14 under 35 U.S.C. §103(a) is respectfully requested.

Claim 15, as amended, relates to a catheter including an elongate, flexible catheter body and an elongate, flexible carrier. The elongate flexible carrier includes a radioactive source housed within a cavity in the distal end of the carrier. At least a portion of the flexible carrier is removable to provide access to the cavity wherein the radioactive source is housed and the flexible carrier is sized and has sufficient strength and flexibility to navigate a portion of the body so that the radioactive source can be positioned at a desired location for treatment. Finally, the device includes a retractable sheath comprising a radiation shielding material.

The Examiner relies on a combination of Dake et al. and Liprie as discussed above with respect to claim 7. Claim 15 is considered to be clearly patentable over a combination of Liprie and Dake et al. since claim 15 now requires the presence of a retractable sheath comprising radiation shielding material, as was originally claimed in claim 19.

The Examiner rejected original claim 19 on the basis of a combination of Dake et al., Liprie and further in view of Hess. The Examiner relies on Hess for the teaching of a device 10 including a retractable sheath or shield 24 that can be drawn back when the radiation source 30 is properly positioned.

However, the Examiner is relying on a combination of a patent directed solely to a catheter (Dake et al.) with a patent directed to a wire assembly for use in combination with a catheter (Liprie) with a patent directed to a wire assembly for use without a catheter (Hess). This is important because the Examiner alleges that it would be obvious to adopt the rather complicated and bulky structure of the Hess sheath into the Liprie device. The applicant disagrees since the skilled person would appreciate that inclusion of the complex, bulky sheath of the Hess device in the device of Liprie is likely to cause serious problems when one tries to feed the wire assembly of Liprie through a catheter.

In fact, Liprie expends a great deal of effort to ensure that the shape of the wire assembly is such that it will easily pass through the tight curves or kinks in the catheter. See e.g. col. 18, lines 43-50. For example, Liprie proposes several tip designs, which are directed to ensuring that the wire assembly can easily pass through a catheter. See e.g. plug 27 of Figs. 1-2, tip 70 of Fig. 5, tip 90 of Fig. 6, as well as the provision of balls 88 in Fig. 6.

More importantly, Liprie suggests rounding off or tapering the tip of the composite source wire 15 to permit the device to navigate tight curves or kinks in a catheter. See col. 12, lines 21-19 of Liprie. In fact, Lipries states at col. 15, lines 30-45 that,

> "The extremely thin, flexible and high strength high dose composite source wire produced according to the present invention provides a consideration advantage for treatment of certain particularly remotely located cancers. For example, in the case of liver cancer and/or pancreatic cancer or related organ cancers, in vivo localized radiation treatment from within the cancerous mass has not been possible using heretofore available source wires. For such treatment it is necessary for the radioactive source to reach and then pass through a catheter implanted in the biliary tract or bile duct, which is an extremely narrow passageway. Radioactive source wires produced by techniques taught by the prior art are too large and inflexible to pass through the duct, much less the even narrower passageway afforded by the catheter implanted therein."

In view of this disclosure, the skilled person would not be motivated to modify the Liprie device by addition of a complex, bulky sheath system as taught by Hess since then the Liprie device would no longer be suitable for its intended purpose of passing through extremely narrow passageways in the body. Accordingly, since the proposed modification of Liprie renders Liprie unsatisfactory for its intended purpose, it cannot support a rejection under 35 U.S.C. §103(a). See e.g. MPEP 2143.01 and *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). For these reasons, favorable consideration and withdrawal of the rejection of claim 15, as amended, is requested.

Claims 16-18 and 20 all depend from claim 15 and are thus considered be patentable over the combination of Dake et al. and Liprie, optionally in view of Hess, for the same reasons as are given for claim 15 above. Neither U.S. Patent No. 6,353,682 (Leavitt et al.), nor U.S. Patent no. 5,405,309 (Carden, Jr.) cures the deficiencies of the primary references Dake et al., Liprie and Hess. Thus claims 16-18 and 20 are considered to be patentable over the cited prior art for the same reasons as claim 15. Favorable consideration and withdrawal of the rejections of claims 15-18 and 20 under 35 U.S.C. §103(a) is respectfully requested.

Claims 21 and 25-27 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Hess in view of Dake et al. and further in view of U.S. Patent No. 5,718,684 (Gupta). This rejection is respectfully traversed and reconsideration is requested for the reasons that follow.

Claim 21, as amended, relates to a catheter attachment including a substrate; a radioactive source associated with the substrate, said radioactive source and substrate being positioned within a portion of the catheter attachment. The catheter attachment includes structure that cooperates with structure on a catheter for releasably attaching the catheter attachment to the

catheter at or near the distal end of the catheter so that the catheter can be employed to position the radioactive source at a desired location for treatment.

The Examiner admits that neither Hess nor Dake et al. discloses a catheter attachment provided with structure for attachment to a catheter. Thus, the Examiner relies on Gupta for teaching a catheter attachment 30 that is secured by bonding to the shaft of a catheter 25. See e.g. col. 3, lines 27-30 of Gupta. Claim 21 has been amended to require that the structure is for releasably attaching the catheter attachment to a catheter. Basis for this amendment is shown in Fig. 1 where the snap-fit 14 is a structure for releasably attaching the catheter attachment to a catheter. Accordingly, since none of the cited references teaches or suggests the feature of claim 21 of providing structure on a catheter attachment for releasably attaching the catheter attachment to a catheter, it is considered that claim 21 is patentable over a combination of Hess, Dake et al. and Gupta for at least this reason.

The examiner has also taken the position that it would be obvious to exchange a bonded connection, such as that taught in Gupta, for a releasable connection but has provided no evidence in support of this position. The applicant respectfully disagrees with this conclusion since the Examiner must show all elements of the claimed invention in the cited references to make out a case of *prima facie* obviousness. Since none of the references show a structure for releasable attachment, one element of the claimed invention is missing and the Examiner has not made out a case of *prima facie* obviousness. Moreover, since Gupta must maintain a fluid communication between the balloon 30 and the fluid flow passage 22, a skilled person would be led away from making the connection in Gupta releasable since that would compromise the fluid connection with the balloon thereby leading to a high probability of leakage. Thus, under the present circumstances it would not be obvious to substitute a releasable connection for the permanent bonding connection disclosed in Gupta as the Examiner suggests.

Claims 22-30 all depend from claim 21 and are thus considered be patentable over the combination of Dake et al., Hess and Gupta, for the same reasons as are given for claim 21 above. Neither U.S. Patent No. 6,353,682 (Leavitt et al.), U.S. Patent No. 4,676,229 (Krasnicki et al.) nor U.S. Patent no. 5,405,309 (Carden, Jr.) cures the deficiencies of the primary references Dake et al., Hess and Gupta. Thus claims 22-30 are considered to be patentable over the cited prior art for the same reasons as claim 21. Favorable consideration and withdrawal of the rejections of claims 22-30 under 35 U.S.C. §103(a) is respectfully requested.

Claims 31 and 33-35 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Hess in view of Gupta. Claim 31 has been amended to incorporate the subject matter of claim 32 therein thereby obviating this rejection.

Claim 32 has been rejected been rejected under 35 U.S.C. §103(a) as being unpatentable over Hess in view of Gupta and further in view of U.S. patent No. 5,645,529 (Fagan et al.). Claim 32 has been canceled without prejudice to resubmission. This rejection, at least insofar as it applies to claim 31, as amended to incorporate the subject matter of claim 32 therein, is respectfully traversed and reconsideration is requested for the reasons which follow.

The Examiner relies on Fagan et al. as teaching that it is well-known that multi-lobed balloon catheters are utilized to prevent occlusion of the lumen in which they are inserted. Fagan et al. provides a balloon catheter that is formed from a plurality of balloons each of which can be inflated independently of the others. If less than all balloons are inflated, it is possible to allow blood to flow through the lumen of the catheter that corresponds to the uninflated balloon. However, this is different than the apparatus of the present invention.

More particularly, Fagan et al. provides several different balloons each of which must be connected to its own lumen to allow independent inflation of the balloons. The present invention, on the other hand, provides a balloon catheter that employs a balloon with a plurality of chambers connected to a single inflation lumen. Thus, the present invention provides an inflatable balloon catheter that does not occlude a vessel or lumen, that can be implemented using only a single fluid passage to the balloon. Claim 31 has been amended to require a single fluid passage to clearly distinguish the present device over the device of Fagan et al. This offers a far simpler device that can be fabricated to fit into smaller body passages since only a single inflation lumen is required. Accordingly, claim 31 is considered to be clearly patentable for at least these reasons. Favorable consideration and withdrawal of the rejection of claim 31 over Hess, Gupta and Fagan et al. is respectfully requested.

Claims 33-35 all depend from claim 31 and are thus considered be patentable over the combination of Hess and Gupta, optionally in view of Fagan et al. for the same reasons as are given for claim 31 above. Favorable consideration and withdrawal of the rejections of claims 33-35 under 35 U.S.C. §103(a) is respectfully requested.

Favorable consideration and issuance of a Notice of Allowance is requested.

Respectfully submitted,

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REDLINE VERSION OF AMENDMENTS TO THE SPECIFICATION AND CLAIMS

Page 4, lines 7-8 of the specification.

Fig. 7A is yet another embodiment of the present invention wherein the radiation source is embodied in microspheres distributed within the catheter.

Page 8, lines 22-28 of the specification.

Fig. 4 shows an alternative configuration for the ~~a~~ catheter 40 in accordance with the present invention. In this configuration, catheter 40 includes a carrier 37 having a sufficiently small diameter that it can be inserted within the catheter 40. Carrier 37 is preferably sufficiently rigid to promote the insertion and removal of catheter 40 from the body in a conventional manner for such catheters. In this regard, carrier 37 may include stiffening elements, not shown, at various locations along its length in order to provide the requisite stiffness.

Page 10, lines 14-34 of the specification.

Fig. 7A depicts a still further embodiment of the present invention similar to that shown in Fig. 1 ~~accept~~ except that instead of pellets or seeds of radioactive source materials the embodiment of Fig. 7A employs microspheres 62 which embody the radioactive source 61. As with the catheter embodiments described above, the radioactive source 61 may be bonded to the outer surface of microspheres 62, as shown in Fig. 7B, or, in the case of hollow microspheres 62, the radiation source 61 may be bonded to the inner surface of the hollow microspheres 62, as shown in Fig. 7C. Alternatively, the radioactive source 61 may be dispersed within the material of each microsphere 62 as shown in Fig. 7D, particularly if the microspheres 62 are made from a polymer matrix material.

~~Micorspheres~~ Microspheres 62 are preferably distributed in catheter 64 in some form of flexible substrate material such as an elastomer, gel, hydrogen, foam or other similar, suitable material 66 to prevent microspheres 62 from migrating from a desired location within the catheter 64, while at the same time maintaining the catheter 64 sufficiently flexible for use.